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VOL. XVII, NO. 14. JULY 1, 1920

THE JOURNAL OF PHILOSOPHY
PSYCHOLOGY AND SCIENTIFIC METHODS

PROFESSOR HENDERSON'S "FITNESS" AND THE LOCUS OF CONCEPTS

PROFESSOR L. J. HENDERSON'S two volumes, *The Fitness of the Environment*[1] and *The Order of Nature*,[2] along with several magazine articles, inaugurate a sort of revival of the old problem of teleology. After adducing certain empirical data, which seem to be both novel and important, he declares that these argue a relation between past phenomena and present that is not mechanical, but is, in some sort or other, teleological. Professor Henderson refrains, being a "man of science," from spinning metaphysical cobwebs around this teleology. Indeed he goes only as far as he feels that the evidence forces him to go, and then, finding himself "face to face with the problem of design," he takes "refuge in the vaguest possible term which can be employed. That term is teleology."[3] By "vaguest" he means of course the least fraught with unwarranted hypothesis and connotation. Partly by reason of this seemly reticence, the brief metaphysical argument which leads him from the facts to teleology constitutes a challenge which the convinced mechanist can hardly afford to ignore.

Professor Henderson has stated this argument very compactly,[4] and in one place has compressed it to a single passage. "The process of evolution consists in the increase of diversity of systems and their activities, in the multiplication of physical occurrences, or briefly in the production of much from little. Other things being equal, there is maximum freedom for such evolution on account of a certain unique arrangement of unique properties of matter. A change in any one of these properties would greatly diminish the freedom. The chance that this unique ensemble of properties should occur by accident is almost infinitely small. . . . Therefore there is a causal connection between the properties of the elements and the freedom of evolution. But the properties of the universal elements antedate or are logically prior to those restricted aspects of evolution with which we are concerned. Hence we are obliged to regard the properties as in some intelligible sense a preparation for the process of planetary evolution. For we can not imagine an interaction between the properties of hydrogen, carbon and oxygen and any process of planetary evolution or any similar process by which the properties of the elements should have been modified throughout the universe. Therefore the properties of the elements must for the present be regarded as possessing a teleological character.''[5]

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[1] Macmillan, N. Y., 1913.

[2] Harvard University Press, Cambridge, Mass., 1917.

[3] "The Teleology of Inorganic Nature," *Phil. Rev.*, 1916, XXV., p. 278.

[4] *The Fitness of the Environment*, pp. 249–273; *Phil. Rev.*, 1916, XXV., pp. 265–281; this JOURNAL, 1916, XIII., pp. 326–27.

If I recall aright, Professor R. B. Perry has somewhere expressed the view that this is nothing more than the ancient argument from design: and such was for a time my own belief. Yet this verdict seems scarcely just to the Professor Henderson, who writes, ''Science has finally put the old teleology to death;''[6] and, ''Experience seems to show that the only kind of hypothesis which can find conclusive scientific support, or sound basis in the phenomena of matter and energy, is a mechanistic hypothesis;''[7] and again, of one of the most notorious strongholds of teleology, ''vitalism has perhaps not had a positive success in three centuries.''[8] Clearly to Professor Henderson's mind, at least, his argument is something very different from anything to be found in Paley or the *Bridgewater Treatises.*

A more pregnant criticism is one that Professor H. C. Brown has made in his review of *The Order of Nature.*[9] ''The treatment of concepts in reaching this analysis, however,'' says Professor Brown, referring to Professor Henderson's analysis of the evidence, ''seems to the reviewer to be a curiously tangled mixture of idealism and scholastic realism.'' In other words the author, as indeed he himself admits, has overstepped ''the boundaries of natural science'' and adventured ''upon the foreign field of metaphysics;''[10] and in so doing has, as he would probably not admit, unsuspectingly introduced a teleology that lay not in his empirical data but was insidiously contained in his procedure and his instruments of thought —his more philosophical concepts.

That this criticism is a sound one I am quite convinced. And indeed this new teleology seems to be an especially interesting illustration of a human frailty which I wish might receive the more explicit attention of philosophers. Briefly, this infirmity can be called the misapplication of concepts, but as a topic of philosophical study it might well be brought under a more general caption—"the locus of concepts." There is, namely, for any concept which the mind entertains a definite locus, or range of applicability: within its locus the concept may be a useful instrument of thought, but if one attempts to apply it outside of its proper range it becomes at once misleading or meaningless. That is, in the latter event, the "concept" ceases to be a concept at all; it vanishes quite, and one has left in one's mind or on one's tablet nothing but the bare word, a verbal image merely, or wasted ink. For a gross illustration, it means nothing to speak of "love" among the inorganic elements. And in general the miscarriage of truth is perhaps not so frequently error, in the familiar sense of an assertion which is significant but untrue, as it is verbiage. This is the most insidious hazard of thought. It were better if only the worthless verbal coin would vanish when the conceptual meaning which is its value has been lost.

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[5] *Phil. Rev.*, 1916, XXV., pp. 271–72.

[6] *The Fitness of the Environment,* p. 311.

[7] *Ibid.*, p. 285.

[8] *Ibid.*, pp. 284–85.

[9] This JOURNAL, 1917, XIV., pp. 557–59.

[10] *Fitness,* pp. 307 and 312.

Now it is, as I think, because Professor Henderson has misapprehended the locus of some few concepts that he finds himself brought, though with obvious reluctance, to his very temperate yet earnest espousal of the cause of teleology. It is therefore for two purposes that I propose the following examination of his argument: firstly, in order to vindicate, if I may so say, the cause of unqualified mechanism; and secondly, in order to illustrate very briefly the locus of concepts.

In the argument of Professor Henderson as quoted above, the concepts whose loci need investigation are—uniqueness, maximum, chance, and preparation. I shall take up these, with some nearly related variants that occur elsewhere in his writings; and in addition, the notion of "changeless" as applied by Professor Henderson to the properties of matter.

1. *Uniqueness.*—We must now look at the argument more closely. All physical and chemical (including vital) processes are properly to be considered as changes of "phases" and of "systems" (Willard Gibbs). Evolution itself depends on the plenitude of such changes. In these changes some of the properties of substances (*e. g.*, the high solvent capacity of water) play an eminent rôle: they figure largely as the causes, or the requisite conditions, of life and of organic evolution. Now Professor Henderson has surveyed the elements and their compounds and *selected out* for further consideration those whose properties do play this important part in life and evolution,[11] that is, those which are fit for this purpose and "fitted" to this end. He has thus slipped in the teleology, at the

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[11] *Fitness*, pp. 248–253.

very outset, which he later brings forth and presents for our respectful admiration. And it is scarcely to be wondered at that the substances so selected appear in the sequel as "uniquely" and designedly "fitted" to bear the burden of both life and evolution.

He, however, does not admit this because he finds that these teleological properties (for I insist that they have already become "teleological" by his own purposive selection) are the properties of very few elements,[12] and these among the most abundant in our universe. That is, life and organic evolution depend mainly on carbon, hydrogen, and oxygen, and these exist in plenty.

To this of course, so far as it bears on teleology, the mechanist replies merely: Well, what of it? Must your teleological properties be distributed with mathematical impartiality among the eighty odd elements? Would you have been less intrigued if your big Three had happened to be a big Four (as it would have been if you had not chosen to exclude nitrogen), or indeed a big Fifty-six? Certainly no mechanist, if he keeps his head, will ever feel concerned over any amount of teleology which Professor Henderson may conjure out of the bag which we have so plainly seen him stuff to bursting when he first stepped on to the stage.

But the mechanist may not keep his head. He may be beguiled and deluded when Professor Henderson so solemnly tells him that these are, not teleological properties, but "unique" properties. Now I suppose the locus of the notion "unique" to be this: (1) a class of objects, (2) which are not all alike. Then, that a single object or group of objects which is (otherwise than "numerically") unlike any other object or group of objects contained in the class may be said to be "unique" in that particular universe of discourse (the given class) and (3) in respect to that property in which it is unlike the other members. Since Professor Henderson is dealing with concrete elements and their concrete properties, every last one of which is in fact unique, he is no danger of applying the term outside of its proper locus. And I should like to know what element or property, or *a fortiori* what group of elements or properties he would care to name as not being unique. Nor is the case any better, as it happens, when he comes to what he calls the "abstract" and "changeless" properties of substances.[13] Each of these is different from the others and is therefore unique. But if this concept is easy of application it is by the same token of very slight significance. Yet Professor Henderson reiterates the word "unique" with an unction, so to speak, as if it reinforced or advanced his argument.

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[12] The convergence of teleological properties is, alas, not without flaw. For instance, mercury has a most enviable and "unique" surface tension which if it had been possessed by water, would have covered our planet with a flora and fauna so luxuriant that Mr. H. G. Wells's gigantesque imaginings (*The Food of the Gods*) would be as nothing. The surface tension of mercury is 436, and that of water but 75 (*Fitness*, p. 126): a strange anti-teleology. And little boron, apparently by no right at all, flaunts a heat of combustion that is second only to that of hydrogen and actually superior to that of carbon (pp. 245–46). Silicon is both fit and unfit; and so is the compound, ammonia (p. 263). Nitrogen is a good element but not good enough to be numbered among the "fittest." And there are other devastating evidences of anti-teleology. If the three superior elements prove that teleology is the order of nature, why do some eighty inferior elements exist at all?

And here we must leave for a moment the locus of concepts for the field of psychology. Why, for Professor Henderson, has the colorless predicate "unique" become in some sense encomiastic and salutary to his purpose? Simply, I think, because his selected elements and properties are "fit" and important ones; that is why he selected them; and he likes them; and therefore he is pleased and not a little impressed on discovering that they are unique. It is by the same emotional mechanism that every furniture dealer has the "most unique" specimen of Old Colonial, and every mother the "best" baby on earth (the superlative case being seized upon by the vulgar under the same tension of feeling). The adjective "phenomenal," through the same mechanism, has been so abused as to be, in all save scientific contexts, worthless. Few of us are sufficiently *l'homme intellectuel* not to note with elation that our own geese are "unique" as compared to other persons' swans.

The term "unique" must be expunged from Professor Henderson's argument. It is purely rhetorical and has no legitimate function to fulfil there: and, like other forms of unremoved refuse, is likely to provide breeding points for germs of error. Thus the statement, "that the properties of hydrogen, carbon, and oxygen make up a unique ensemble of properties, each one of which is itself unique,"[14] when purged of emotional warmth, becomes a statement that is less likely to overawe and to mislead; *viz.*, that the properties of hydrogen, carbon, and oxygen make up an ensemble of properties, each one of which is. Any mechanist will assent to this.

II.

2. *Maxima and Minima.*—"Each of these properties [of the three elements] is almost or quite unique, either because it has a maximum or a minimum value [the minimal value of some properties determines of course maximal "fitness"] or nearly so, among

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[13] I am aware of a certain error that Professor Henderson could make in self-defense at this point by appealing to his scholastic realism. But rather than complicate the argument here, I shall wait to see if he makes it.

[14] *Phil. Rev.*, 1916, XXV., p. 268.

all known substances, or because it involves a unique relationship or an anomaly."[15] The terms "maximum" and "minimum" are here used correctly, and indeed their proper locus is all but unmistakable. This is the end terms of a series of objects which are serially ordered according to the magnitudes of some one property or quality possessed by all the objects.

We should notice here that the fact that the maximal values of Professor Henderson's teleological properties are not distributed at random among the eighty odd elements, but do accumulate (as "modes") on carbon, hydrogen, and oxygen, is one that may well interest us. He calls this fact the "pattern;" and I shall revert to the pattern later. These three modes are interesting, of course, just as any pronounced empirical modes are interesting. But if he supposes that they are "teleologically" interesting, as he does, this is only because the properties so plotted are the "teleological," the "fit," properties which he originally selected.

Although the loci of "maximum" and "minimum" are all but unmistakable, yet even here human ingenuity can find out the way of error. In speaking of the pattern Professor Henderson says: "This order has for cosmic and organic evolution extremely important results—maximum stability of physico-chemical conditions and maximum complexity in the physico-chemical make-up of the surface of our planet; further, the possibility of maximum number, variety, complexity, durability and activity of physico-chemical systems in such an environment. . . . No other environment . . . could so highly favor. . . . This environment is indeed the *fittest.*"[16] In other words because three very common elements possess many properties each of which is favorable to the formation of diverse systems (while some eighty other elements do not possess these advantages), Professor Henderson concludes that just this concentrated distribution of these properties is the most favorable to their maximal cooperation in the evolution of the universe. This is a leap in the dark such as Professor Henderson may expect of any metaphysician, but which no metaphysician would expect of Professor Henderson. For the most elementary experience teaches that when properties are combined the strangest things happen to their maxima and minima in the combined function. Properties are not in general simply additive; and still less so are maxima and minima. But if they were, a fitter universe would of course be one in which all of the participating elements possessed what are at present the maximal fitnesses.

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[15] *Phil. Rev.*, 1916, XXV., p. 267. The first use of "unique" in this passage is of course fallacious; it unwarrantably *restricts* the locus by implying that only the two end members of a series of different objects are unique; or again that only an "anomaly" is unique. The second use is correct but idle. The vicious effect of the term is readily perceived.

[16] *Phil. Rev.*, 1916, XXV., p. 269.

I am not sure that the problem thus raised is one that can be even stated in rigorous scientific form. But the difficulties besetting Professor Henderson's path at this point will be sufficiently illustrated by a single consideration. It is a familiar fact in chemistry that the more complex substances are in general the less stable. And certainly the "complexity" and the "activity" of physicochemical systems are in some measure at least (if not *diametrically*) opposed to their "durability." Now apart from the two minor questions: what distribution of component properties each in a general way maximally favorable to the activity of systems will be maximally favorable to the activity of the system in which they are combined, and the parallel question respecting durability; there is the further and more serious question, what degree and distribution of activity and what degree and distribution of durability will make for the maximum success of the evolutionary process. Heat favors chemical activity, and water, excellent solvent, favors chemical activity, but the system which tried to combine the greatest amount of heat with the greatest amount of water would not be the "fittest" for either activity or evolution. For there is a degree of heat that destroys water, and much else. These questions, if they are soluble at all, are staggeringly intricate. I do not discover that Professor Henderson has considered them.

In terms, once more, of the locus of "maximum" and "minimum," the objection which I raise is that the maxima and minima of component functions can not be simply added to give the maxima and minima of the combined function.

3. *Chance, Probability, and Possibility.*—The notion of "possibility" has been implicitly involved in our preceding argument. For the question whether a different distribution of their properties would more conduce to "cosmic and organic evolution" means "different from the actual" in both cases. It is equivalent to asking whether other arrangements could be a better "preparation for the evolutionary process." If not, the actual arrangement is the best possible. And in fact a comparison with other "possibilities" is everywhere involved in Professor Henderson's argument. This is often explicitly stated, as in the following sentence. "Given matter, energy, and the resulting necessity that life shall be a mechanism, the conclusion follows that the atmosphere of solid bodies does actually provide the best of all possible environments for life."[17]

Now the loci of those concepts which involve any species of potentiality are perhaps the most difficult and most frequently misunderstood of all. And a complete treatment of them would involve the theory of cognition itself, for there is no "potentiality" except in a situation where a cognizer is making some sort of forecast. But this would go beyond our present compass, and for the case in hand a briefer treatment will suffice.

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[17] *Fitness*, p. 273.

In Professor Henderson's use of "possibility" he contemplates, or essays to contemplate, all of the "possible," which is to say the thinkable, permutations of arrangement among the actually observed properties of elements and their compounds. This is a free and gratuitous act of the imagination, save only that the properties thus imaginatively permuted are, severally, actual properties. It is comparable to a child conceiving of a mountain of sweets—the biggest mountain, the sweetest sweets, and the least conducive to stomach-ache. But such imaginative permutations of entities, although each entity be a real, notoriously leads one to more impossibles than possibles. And a free sweep of the imagination is not the true locus of the concept "possibility."

It is, however, from this that the concept has evolved. After the pictorial imagination has run its course the criterion needed, in order to separate the possibles from the impossibles, is this—which, now, of these alleged "possibles" can be done; which can be concretely realized? With this a notion of causation and of the manipulation, or else of the spontaneous cooperation, of actual causes to produce concretely one or more out of the many imagined effects, enters into the locus. If it is the spontaneous cooperation of causes producing this end, which we envisage, we here branch off into the nearby field of "chance" and "probability." If it is the manipulation, by ourselves or others, then it next appears that one does not know, *sensu strictiori,* which of the alleged possibles can be realized until one has realized it. But with that the "possible" becomes an actual. Clearly the locus of "possibility" stops somewhere short of this.

It does, but at a point which is not defined by logical, but by merely psychological, considerations. Thus a human element of caprice, conjecture, belief or faith—more or less accepted by the crowd—inheres in the notion of "possibility." It is irremediably a psychological, and more or less a social, concept. Its locus is not sharply defined because the degree of plausibility or expectation required to make an effect "possible" is fixed by no convention. It increases with the advance and diffusion of knowledge; it varies from one social group to another.[18] For some persons conversation with departed spirits is "possible;" for others a forecast of the weather or the commission of a voluntary act is "impossible." For these, and several other, reasons the concept of "possibility" has no proper place in science.[19] It is, however, often enough used by scientists, but generally only after some consideration at least of real causes that have in other circumstances produced the imagined effects, or effects very similar; of the accessibility of the causes to actual manipulation; *etc., etc.* Of such cautions I discover no trace in Professor Henderson's argument.[20] The "possible," yet so much less "fit" or desirable, other permutations of the properties of elements and their compounds are the free creations of his imaginative faculty. And when one is considering such fundamental matters as the properties of substances one knows too little of their antecedent causes to be able to speak circumspectly about what were "possible." This fact applies even more significantly in connection with Professor Henderson's use of "chance" and "probability."

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[18] In studying the locus of concepts one must not forget that they are undergoing evolution. As compared with some concepts, that of "possibility" is in a state of "active mutation."

This unique ensemble, he says, can not have come about by chance: "the possibility is negligible that conditions equally favorable to the production of diversity in the course of evolution should arise without cause."[21] And again, "There is, in truth, not one chance in countless millions of millions that the many unique properties of carbon, hydrogen, and oxygen, and especially of their stable compounds water and carbonic acid, . . . should simultaneously occur in the three elements otherwise than through the operation of a natural law which somehow connects them together."[22] The upshot of which is, "that the connection between the properties of the three elements and the evolutionary process is teleological and non-mechanical."[23]

In this application of "chance" Professor Henderson makes two errors either of which would be fatal. The least situation in which chance can be spoken of is: two (or more) causal sequences, and an observing computing organism; further, the causal sequences are relatively independent, but they are about to interact, or meet; further, the observer knows this but owing to the relative apartness of the causes he is able to deduce or predict only very imperfectly some features of the expected interaction: these unpredictable features he declares to be "subject to chance." Nothing less than this is the locus of that concept, and essential to its legitimate application. In the old illustration of the die, the shape and homogeneous composition of the die, its relation to gravity, and the quality *etc.* of the table top may be taken as one causal sequence; the original (and unknown) lie of the die in the box derives from another causal sequence; the movements of the shaker's arm, and the relation of this to the table top, are a third causal sequence. In the die when it finally comes to rest on the table these three sequences have met. The number that comes "up" was unpredictable, and the fact that *it* comes up is ascribed to "chance" by the person who was interested but could predict only that *some* number would lie uppermost. The instant that the causal sequences have met and the die rests on the table, the locus for chance has expired. And obviously, "chance" is another psychological concept —it involves in its very locus a knower.

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[19] It may be that few persons will agree with this assertion. But I should be willing to go still further, and assert that no one of the potentiality concepts finds any proper employment in science: that the work of science is but imperfectly accomplished until all scientific propositions have been reduced to the indicative mood. All equations *are,* of course, in this mood.

[20] An ambitious student would find in Professor Henderson's writings capital material for a doctorial thesis on the concept of possibility; for which he might select the captivating title, "What would the Universe be like if it were other than it is?"

[21] *Phil. Rev.,* 1916, XXV., p. 271. The mechanist believes that nothing arises "without cause."

[22] *Fitness,* p. 276.

[23] *Phil. Rev., loc. cit.,* p. 278. Throughout this stage of his argument Professor Henderson uses the notions of chance and probability in a way that I am bound to call reckless.

Now, first, when Professor Henderson speaks of "countless millions of millions" of chances, he is either (1) thinking of a many-faceted die (or some comparable mechanism) with all the properties of all the elements and their compounds inscribed each on a facet, no facet remaining blank; and this die is shaken countless millions of millions of times. And he has no right to such an assumption. Or (2) he is not thinking of a die, is making his permutations mentally (by the mathematician's handy method of syncopation),[24] and again he has not got the locus of chance—those real but unpredictable causal sequences that are to meet. Both objections reduce to the fact mentioned above, *i. e.*, that we know too little of the causes that lie behind the properties of matter to envisage even the situation, the locus of chance.

Secondly, Professor Henderson argues that after one actual arrangement of the properties has been selected by nature from the countless millions of millions of arrangements which he alleges to be "possible," the chance of *this* arrangement coming out was very, very small. Is Professor Henderson unaware that after the event there is no "chance"? Or, in other words, that the "chance" of any event that has actually taken place is exactly equal to unity?

Professor Henderson, in the quality of "man of science" and doubtless rightly enough, heartily despises the "philosopher," yet

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[24] The same syncopation that leads to the "completed infinite," and other paradoxes.

I think, if he will consider a bit analytically the current scientific notions of chance and probability, that he will find some neat little antinomies that may call to mind glass houses. One of these antinomies is that any event before it happens has a vanishingly small chance; while after it happens, it had always been certain to happen, had always had the probability one. Such pitfalls can be avoided only by observing very carefully what the true locus of chance is. And any one who does this will soon find that there is neither chance nor probability "in nature," and also, perhaps, that a theory which purports to enable us to cash in our ignorance, to predict where we can not foresee, needs some revision. Portions of the theory of probability are among the modern scientist's last remaining forms of magic.

III.

4. *Preparation.*—"Hence we are obliged to regard the properties as in some intelligible sense a preparation for the process of planetary evolution. . . . But we are ignorant of the existence of any cause except the mind which can thus produce results that are fully intelligible only in their relation to later events."[25] "In short, we are face to face with the problem of design." I take "refuge in the vaguest possible term which can be employed. That term is teleology."[26] In another place Professor Henderson refers to "teleology" as "the vaguest possible term which can be imagined, from which all implication of design or purpose has been completely eliminated."[27]

Now "preparation" is of course inalienably a psychological concept: it presupposes a preparer who is looking ahead or, as indeed Professor Henderson perceives, a mind. But now this "preparation" he rechristens "teleology," and then lightly asserts that from "teleology" "all implication of design or purpose has been completely eliminated." I submit that this is a very pretty case of wresting a word from its locus, its meaning. Of course the word "teleology" has now become printer's ink.

But it was in 1917 that Professor Henderson took this step. In 1916 he wrote as follows: "Here it may be pointed out that biological organization consists in a teleological and non-mechanical *relationship* between mechanical things and processes. In both cases the relationship is rational and non-mechanical, the things related mechanical and non-rational. Or, in other words, the relation is an affair of the reflective judgment, the things related of the determinate judgment. It is the failure to understand this distinction which is at the bottom of most misunderstandings concerning teleological problems in biology.''[28] Now whether Professor Henderson intended it or not, this capitally states the locus of ''teleology.'' The teleological relation *is* an affair of the reflective judgment, of Professor Henderson's reflective judgment. And if he, and others like-minded, cease to reflect in this vein, there is no teleology save the meaningless printed word scattered here and there through books. It is merely the human judgment that imputes to the pattern of the properties this ''fitness,'' this ''quality of preparation.'' The pattern is merely what it is.

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[25] *Phil. Rev.*, 1916, XXV., p. 271.

[26] *Ibid.*, p. 278.

[27] *The Order of Nature*, 1917, p. 204.

'' 'Why,' '' as Professor H. C. Brown has said, ''taken teleologically, has meaning only in the responses of the conscious organism where ideas, as anticipations, become motives and determine them. It is not the universe, but only certain organisms that have a structure making such ideal anticipations possible.''[29] And as Professor H. C. Warren has said; ''In short, the arguments so far advanced for 'peculiar fitness' lead merely to the meaningless conclusion that the fitness of things is what it is. . . . If the action of a directing agency during the *course* of events is unsupported by evidence, there is no *a priori* ground for assuring [assuming?] such a directive agency at the *beginning* of events.''[30] And again, ''while we may conclude, on the basis of empirical evidence, that 'history' in its widest sense shows a *trend*, our present scientific knowledge does not indicate that it manifests a *purpose*.''[31] No, the ''purpose'' is injected by the private ''reflective judgment'' which, in an exuberant moment, is sometimes led to marvel at the beautiful way in which events ''prepare'' for what is to come; or again, at the beautiful way in which they ''fulfill the promise'' of what has gone before. The correlative notions of preparation and fulfilment are both the work of the non-scientific imagination.

5. *Changelessness.*—''Nothing is more certain than that the properties of hydrogen, carbon, and oxygen are changeless throughout time and space. It is conceivable that the atoms may be formed and that they may decay. But while they exist they are uniform.''[32] ''Accordingly, the properties of the elements are to be regarded as fully determined and perfectly changeless in time. This we may take as a postulate. But the abstract characteristics of systems are no less fully determined and absolutely changeless in time. This is a second postulate.''[33] The connection between

[28] *Phil. Rev.*, 1916, XXV., pp. 278–79.

[29] This JOURNAL, 1917, XIV., pp. 558–59.

[30] This JOURNAL, 1916, XIII., pp. 66–67.

[31] *Ibid.*, p. 70.

[32] *Phil. Rev.*, 1916, XXV., p. 275.

[33] *Ibid.*, p. 277. See also *Fitness*, p. 280, note 1.

the pattern and evoluton "because it is merely a relationship and in no sense a mechanical connection, because it is unmodified by the evolutionary process and changeless in time, is to be described as teleological."[34] Now if the elements have evolved and if not still evolving still may decay, as Professor Henderson admits[35] may be the case, how shall their "properties" have been, and still be, "absolutely changeless"? Doubtless because they are "rational" and abstract entities: as may be inferred from the quotations just given, and from the following: "For these laws [the laws of nature] are exclusively rational; they are the product of the human reason, and are not conceived by science to have objective existence in nature. This is also clearly true of the relation betwen the properties of the elements and the course of evolution."[36] The laws of nature, then, the properties of matter and their relation to the course of evolution are all, as Professor Brown has intimated,[37] scholastic reals. They have the same metaphysical status as Platonic ideas.

Now I trust that it is not an early book of mine called *The Concept of Consciousness* that has so grievously misled Professor Henderson. Probably not, for if he had read that book he would have seen at once what an absurd hocus-pocus I there conjured up[38] because I did not at that time know the true locus of the "timeless and changeless" entities. And he would not have made a like mistake.

Adequately to discuss the locus of these entities in a world where "everything flows," and thus to deal fundamentally with Professor Henderson's error in supposing that abstract and changeless properties of matter have anything to do with the course of evolution, would involve us in the whole theory of knowledge and especially in a discussion of the locus of "unreality." But happily Professor Henderson's own words provide a readier *reductio ad absurdum.* For is it not self-evident that if the real atoms and molecules of the universe are in active evolution, then their real properties are actively changing. Whatever, then, abstract and changeless "properties" may be, or wherever they may be, they are not concerned in this process of evolution and decay. They can not influence it in any way. In Professor Henderson's own words, the laws of nature "are exclusively rational; they are the product of the human reason, and *are not conceived by science to have objective existence in nature. This is also clearly true of the relation between the properties of the elements and the course of evolution*"[39] (italics are mine). If these things have no objective existence in nature, then also teleology has no objective existence in nature. Their locus is in the human mind, and there alone do they operate as causes. Such abstract entities and relations can make Professor Henderson write *The Fitness of the Environment* (or me, a similarly mistaken book). This is all that the mechanist wishes to prove.

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[34] *Ibid.*, p. 279.

[35] *Ibid.*, pp. 265, 275: *Fitness*, p. 303.

[36] *Ibid.*, p. 276.

[37] This JOURNAL, 1917, XIV., p. 558.

[38] Especially in the chapter on "The Neutral Mosaic." To Dr. H. M. Kallen and Professor A. W. Moore I am indebted for some very just and excellent criticisms of the mistakes that I there committed. I intend to take up these criticisms in detail at another time.

CONCLUSION: THE PATTERN

Professor Henderson's work on "fitness" consists of two distinct parts. The one, an empirical study of the properties of the chemical elements and especially of hydrogen, carbon, oxygen and two of their stable compounds, brings out a series of facts which he has called the "pattern." The other part is an argument for teleology. And, although based on the pattern, it is a metaphysical argument. It employs among several philosophical concepts two or three of the most treacherous which are to be found in the apparatus of human thought. I have tried to show that several of these concepts have been used by Professor Henderson without a due regard to their true locus,[40] and that for this reason his argument for teleology is null and void. Indeed I see not one iota of value on the teleological side of Professor Henderson's contributions, nor do they, in my opinion, cast the faintest shadow on the path of the most uncompromising mechanist.

With the other portion of these contributions, the empirical pattern, the case is very different.[41] And I do not wish to leave the subject of "fitness" without further mention of the pattern.

The "pattern" means the pattern of distribution of the physical and chemical properties of the elements and their compounds. As we have seen, Professor Henderson, after an extended analysis, finds that hydrogen, oxygen, carbon, and their two compounds, water and carbonic acid, are the chief bearers of the process of evolution.[42]

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[39] *Phil. Rev.*, 1916, XXV., p. 276.

[40] In the present paper I have not begun to exhaust the metaphysical tangles in which Professor Henderson has involved himself in the several versions of his teleological argument.

[41] Apart from the "pattern," moreover, the volume on *The Order of Nature* has an importance of its own.

[42] In his judicious review of *The Fitness of the Environment*, Professor S. O. Mast says: "It is to be regretted that other factors were not included in this thorough study, especially nitrogen and its compounds." He also remarks that "a thorough and altogether excellent treatment of the same general subject

Now this is interesting; and especially if, instead of asking what were the "chances" of this happening so, we ask what specific processes have led to this result.[43] In other words, human interest and investigation may well be directed toward these elements.

In other fields of inquiry we have come to suspect that any "pattern," anything other than homogeneous mixture and random distribution, is itself the product of evolution. Indeed is this not, in a sense, a scientific maxim? And is this pattern of the properties, then, not a valuable empirical cue for further investigation? Professor Henderson says that "in accordance with the general method of science, we must assume that the origin of environmental fitness lies at least as far back as . . . the evolution of the elements, if they were ever evolved."[44] And it is conceivable "that at an early period the chief cosmic process was the evolution of the elements themselves."[45] "Biological science has not been able to escape the recognition of a natural formative tendency, which Darwin identified as the result of natural selection. And now it appears to be necessary to postulate a like tendency in the evolution of inorganic nature."[46] "Moreover," as Mr. W. C. D. Whetham has said, "from our present point of view, a common basis for matter [*i. e.*, the electron of Lorentz and Larmor] suggests or implies a common origin, and a process of development possibly intelligible to our minds. The idea of the evolution of matter becomes much more probable."[47]

Furthermore, some of the reasons for "the coincidence of properties," as Professor Henderson himself shows,[48] are already clear; and they are simple enough.

Now from looking at the higher levels of evolutionary development one seems to perceive that any single step in evolution starts with a disordered field of independent objects (atoms, molecules, colloids, animals, men, nations) which impinge promiscuously on one another's spheres of influence: some of these random collisions result

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containing similar conclusions appeared in the *Bridgewater Treatises* approximately one hundred years ago" (*Biologisches Centralblatt*, 1914, XXXIV., p. 436). A study of the pattern is also to be found in the opening sections of Spencer's *Principles of Biology*. Professor Henderson's work amplifies and brings up to date such earlier studies.

[43] Professor Henderson has also asked this second question. In this respect there seem almost to be two Professor Hendersons; and I doubt that the reader will readily reconcile some of the passages about to be quoted with some of those that have been quoted previously.

[44] *Fitness*, p. 304.

[45] *Ibid.*, p. 303.

[46] *Ibid.*, p. 280.

[47] "The Evolution of Matter," in the Darwin Centenary volume, *Darwin and Modern Science*. Cambridge University Press, 1900, p. 569.

[48] *Fitness*, pp. 276–77; and elsewhere.

in two or more of the objects becoming attached to each other with a force that is more or less able to withstand further impacts from outside. Thus new and more complex units are formed, a higher "level;" and these, in turn, in no as yet ordered arrangement. But their degrees of stability are very diverse. Of the combinations thus formed some, in the same way, enter into still higher syntheses and so "evolve;" others seem merely to hold their own, but not further to "evolve;" while still others sooner or later break down again into their component parts. Such a picture of the evolutionary step seems to emerge if one studies the relations of atoms to molecules, of molecules to colloids, of individuals to social groups, of clans to nations.

Thus at any level of stability some, but not all, of the promiscuously inter-impinging elements are the bearers of the subsequent steps of evolution. *We call* these the "important" or the "fittest" elements of that level, the "successful" products of the preceding evolutionary stages. But in using such terms we must not forget that *we* are frankly adding reflection to unreflecting nature. The fact is that some combinations survive, and we call these the "fittest."[49] Now in this sense hydrogen, carbon, and oxygen seem to be the most "successful" products of that evolutionary stage in which electrons (or whatever the earlier components are eventually found to be) combine into the chemical atoms; just as the higher vertebrates seem to be the most successful products of the biological level of evolution. And Professor Henderson's "pattern" is a handsome contribution to a line of investigation which is bound to be, unless I am much mistaken, the main-line of physico-chemical progress; the investigation, that is, of the interrelations of atomic properties; an inquiry of which the periodic classification of the elements is already one of the fruits. The "teleological' significance of the pattern is illusory: its sober actual value may be very great. It is certainly great enough to need no factitious enhancement.

One wonders, lastly, whether "teleology" is with Professor Henderson more than a passing fancy. For certainly the most rigorous mechanist will hardly disagree with the Professor Henderson who declares that, "beneath all the organic structures and functions are the molecules and their activities. These it is which have been moulded by the process of evolution, and these no less have formed the environment."[50] And again: "The perfect induction of physical science, based upon each and all of its countless successes in every department of physics and chemistry, conclusively proves that the whole process of cosmic evolution from its earliest conceivable state to the present is pure mechanism."[51]

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[49] The late Félix Le Dantec has said that, since "fittest" is a predicate which can be assigned only after the fact (of survival), the Darwinian theory of natural selection is "a mere convenience of language," which explains nothing (Preface to the *Œuvres Choisies de J.-B. Lamarck.* Flammarion, Paris). My present use of the word "fittest" is not that of Professor Henderson, but it has interesting relations thereto.

EDWIN B. HOLT.

THE IDEALITY OF VALUES

I

I SHALL take as my starting-point the pragmatic premise that all values are functional, that they are relevant to the particular instances or the concrete conditions in which they are employed—yes, more than that, they are not only relevant, but they are determined by these particular instances or by these concrete conditions. John Dewey has brought out so forcibly and clearly in his *Essays in Experimental Logic* that values are relative, that they are subject to the empirical, that further elaboration can hardly be necessary. However, for those who are not yet oriented in the method that Pragmatism uses to establish values and standards and criterions I shall briefly cover the position of Mr. Dewey, confining myself solely to the problem of determining values, for it is the analysis of the problem of values with which we are concerned.

Values are dynamic, evolutionary and changeable. Above all values are practical. Dewey says, "a judgment of value is simply a case of a practical judgment, a judgment about the doing of something."[1] The value of an act or of a condition is wholly determined by the criterion of the individual experience. Does the act or condition fit into this experience; if so, it has a value for the individual which is both real and genuine. The interpretation of these values is wholly from the standpoint of the individual: he is the loser or gainer thereby, and it is he who should be the supreme judge of the value, of the fact, or of the condition. Value originates and thrives through the actual experience of the individual, and it is only as acts or conditions fit into the mass of experience that their value can be determined: "value has its seat necessarily in human nature. . . . Value is a content of nature, having its roots in her conditions and its life in her force."[2]

Take, for instance, such a proposition as this: Shall I go out this afternoon to play a game of golf? Before I can answer this ques-

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[50] *Phil. Rev.*, 1916, XXV., p. 265.

[51] *Fitness*, p. 304.

[1] Dewey: *Essays in Experimental Logic*, p. 358.

[2] Kallen: *Creative Intelligence*, p. 412.